

Design of a Subject-Oriented Reference Model for Change Management

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Abstract. The ITIL is an established presence in ICT practice, which allows some scope for domain-specific implementation. The complexity of existing IT solutions and ever shorter development times are causing increasing problems in implementing the ITIL processes. This paper takes up this problem with reference to Change Management and shows how it has been addressed in practice with the aid of subject-oriented Business Process Management (S-BPM) and reference modeling. The description of the problem is followed by a discussion of the conceptual foundations of the ITIL and the central features of S-BPM, which is used to design a conceptual reference model for the domain of Change Management. This model is presented with focus on the involved subjects, their interactions and behavioral patterns. We substantiate the practicability of the model using a generic example and finally conclude potential benefits.

Keywords: Change Management, Reference Modeling, ITIL, S-BPM, IT Service Management.

1 Introduction

Because of technological and economic developments, IT service providers have to produce more and more complex IT solutions in shorter and shorter development cycles if they are to succeed in the marketplace (see [24], p. 247). This phenomenon is currently referred to as “dynaxity,” a mixture of dynamic change and complexity [11]. It can also be observed in practice that the processes of producing IT services are increasingly driven by internal IT Governance policies, while the resulting customer satisfaction is only incidentally addressed. In light of this situation, IT service providers can fall into a complexity trap: the increased complexity of the services demanded by the market and the host of internal rules to be complied with lead to rising costs, so the resulting gains show a declining trend.

The reaction of management to this development is often to reduce the available staff resources to safeguard the company’s financial results. To tackle this ever-growing complexity, the players who have to modify and implement the processes involved in IT service production are then often left managing shadow processes [22].

Because of a lack of transparency, these often escape management control, so quality problems are almost bound to arise. In the worst case they may fall into a vicious spiral, sustained by declining financial results on the one hand and increasing pressure from management to impose control on the other.

In particular, the identified complexity trap exerts massive pressure upon the domain of Change Management, which is responsible for the efficient handling of all changes of the IT infrastructure. Typically, such tasks require specific and intense communication between different organizational units, such that enterprises are confronted with high coordination costs [14]. In order to gain efficiency in the domain of Change Management, process orientation and adequate process-oriented information systems seem to be suitable means [12].

Widely-used IT management frameworks such as the ITIL offer no constructive solution to unfold process orientation. The ITIL does define Change Management tasks with which tactical and operational changes to IT services can be organized, coordinated and controlled (see [25], p. 181). However, it provides no detailed process models covering the logical sequence of the necessary Change Management activities (see [24], p. 122ff., and [13]). Given the dynamic nature of the market outlined above, such process models must be extremely adaptable [9] and capable of being rapidly rolled out into production in IT organizations [6].

To address the set of problems outlined here, this paper presents a conceptual reference model [21] for ITIL-based Change Management. A reference model has the fundamental potential to reduce the production costs of an implementable Change Management process that meets the company's needs or to optimize an existing Change Management function [1,4]. To meet the requirements of the domains in question, we have based the design of the reference model on the concept of subject-oriented Business Process Management (S-BPM) [7]. As well as transparent modeling of the players involved, along with their activities, this allows processes to be executed without any programming effort (model-to-execute). This means that the processes can be tested and adapted by the players concerned, providing a high degree of organizational flexibility and acceptance. The resulting subject-oriented model for Change Management has been developed in an evolutionary manner over several years within an IT service organization, and is presented here in a generalized form.

This paper begins by introducing some key principles of Change Management. Based on the central features of S-BPM, we then discuss the subjects, interactions and relevant behavioral aspects of the reference model. In order to substantiate the practicability of the designed model, we introduce an example scenario, which subsequently is expanded by a data layer. Finally, a summary is presented and potential benefits of the designed artifacts are concluded.

2 ITIL Principles

The IT Infrastructure Library (ITIL) is a process-oriented collection of best practices for planning, monitoring and managing IT services [25]. The ITIL has developed into

a international de-facto standard for IT service providers (see [24], p. 122) and enables IT services to be aligned with current and future requirements.

The core of the ITIL comprises five modules: Service Strategy, Service Design, Service Transition, Service Operation, and Continual Service Improvement. Change Management forms part of the Service Transition area and is intended to keep the impact of changes on all operational services, and hence on IT costs, to a minimum (see [25], p. 195ff.). It coordinates, controls and establishes the activities needed to manage Changes. The area of Change Management encompasses the live operation that is relevant to service provision, and the associated administrative environment (see [15], p. 45). Each individual Change is entered in the Change Record (RC). This document contains all management-related information, and the history of a particular Change. A Change is a modification or functional enhancement to an existing system (e.g., hardware or software, or IT infrastructure). The details of a Change are gathered as the process is carried out and are then provided by the Request for Change (RFC) [20].

To handle the operation of Change Management, the ITIL provides for various roles (see [18], p. 49). The Change Manager is the highest operational instance and assumes the responsibility for the process. The Change Coordinator supports the work of the Change Manager by helping to define and describe the change in detail. The Change Advisory Board (CAB) is a group of decision-makers (technical and administrative) with a suitable overview of the whole system, which examines the impact of each proposed Change and supports the implementation of the Change (see [15], p. 98).

Although the ITIL claims to provide a comprehensive approach to IT Service Management, clear gaps appear when we compare the contents of the ITIL with the tasks of production management (see [24], p. 123). There are significant shortcomings in the management of the production process in particular. For example, the ITIL provides little or no coverage for production planning and production control. Only production change has reasonable coverage, so there is scope for improvement overall.

The ITIL does not include any industry- or company-specific recommendations. Although the generic description of the best practices discussed in the ITIL allows them to be adapted to a wide range of application areas, this adaptation has to be performed by the company itself (see [24], p. 125ff.). The ITIL is a good framework for creating standardized processes within a company, but the staff are then forced to work according to certain rules which must be compliant with the IT Governance policy, which results in greater organizational costs.

3 Reference Model for Change Management

3.1 S-BPM Fundamentals

S-BPM is a comprehensive method for the correct implementation of an integrated BPM approach (see [7], p. 20). This approach can be considered to be integrated as

the individual phases (analysis, modeling, validation, optimization, implementation, verification and acceptance, and operation and monitoring) form a closed loop (see [16], p. 14). The S-BPM notation is based on natural language with complete sentences comprising subject, predicate and object, and in contrast to traditional BPM, it focuses on the subject of a process. Modeling in S-BPM takes places in two stages (see [5], p. 54):

1. Identification of the subjects and their interactions → What are our subjects?
2. Definition of the subject behavior → What does a subject do, and when does it send or receive a message?

The result of the first step is a *subject interaction diagram* (SID), which forms a model with explicit communication relationships structured by the involved subjects. Fig. 1 shows an example subject interaction diagram created with the S-BPM modeling tool Metasonic Suite V. 5.0.1 [19].

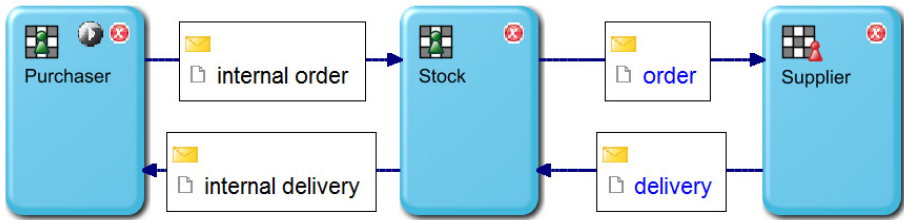


Fig. 1. Example subject interaction diagram (SID)

In the second step, the subjects are refined by modeling their behavior as a sequence of activities and interactions with the aid of states and transitions. Several subjects can act in parallel and synchronize themselves by means of messages (see [5], p. 54ff.). The behavior of every subject can be specified using three states and transitions: *Send*, *Receive* and *Function*. Five symbols are used in S-BPM notation (Fig. 2).

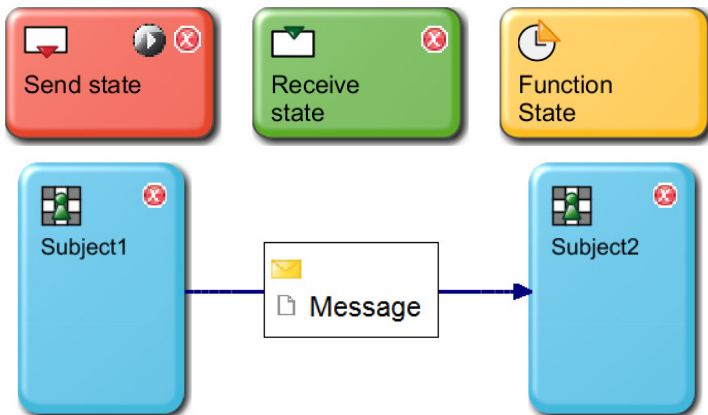


Fig. 2. Symbols in S-BPM notation

The *subject behavior diagram* (SBD) shown in Figure 3 models the processing of an order. After the receipt of the order (Receive state), the stock level is checked (Function state) and the control flow branches. Individual states can be refined, e.g., to assign the activities to external applications, information objects or business rules (see [5], p. 56).

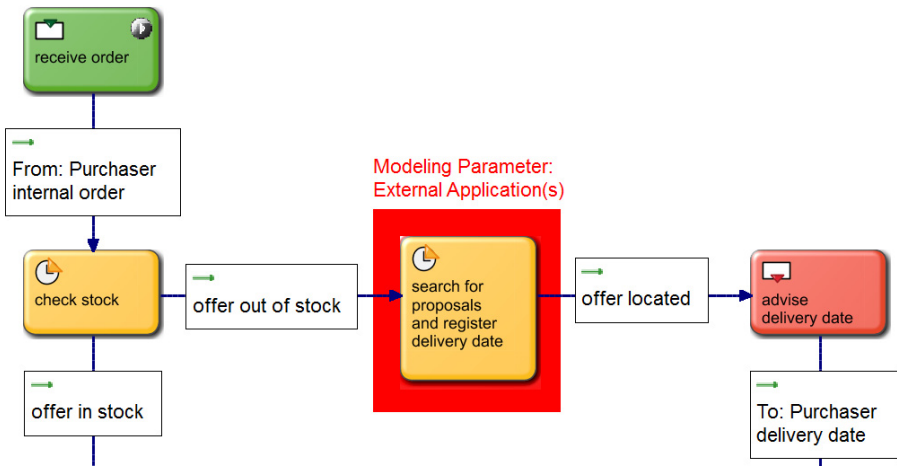


Fig. 3. Example subject behavior diagram (SBD)

The simple notation used in S-BPM makes the resulting models very easy to understand. The models can also be executed without any additional programming effort (model-to-execute). This allows models to be tested in the actual work process and adapted to suit. These attributes are the reason why S-BPM is applied below to the domain of Change Management.

3.2 Subjects and Interactions within Change Management

The subject-oriented reference model (SID) shown in Figure 4 is based on a Change Management process that has been developed and optimized over many years by a system integrator for the live running of SAP Basis services. Because of the practical application, some elements differ from the relevant literature, but they are tried and tested and therefore constitute an adequate reference for different domains.

To reflect the generic character of the reference modeling activity, we will dispense with describing all the elements of Change Management in detail. Because of the many special rules and actions in the case of an incident, this area is not considered at this time.

From the SID we can see the following subjects involved in Change Management: the Change Requester, Change Coordinator, Change Implementer, Change Manager and Change Approver.

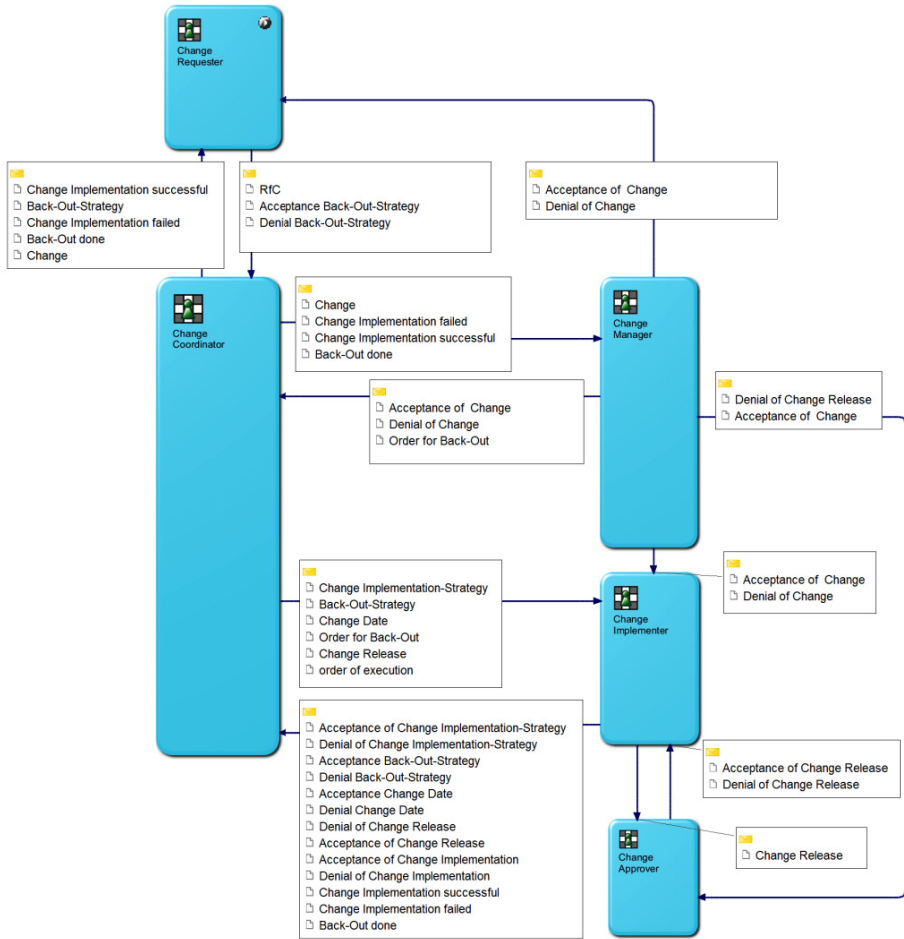


Fig. 4. Subject interaction diagram for the Change Management process

Changes may be internal or external. In the external case, the *Change Requester* will engage in an active dialog with the customer, enter the customer requirements in the Request for Change (RfC) and provide this to the Change Coordinator. In the internal case, it has to be decided whether the functional area into which the Change falls should handle the tasks of the Change Requester itself or entrust the production of the RfC to an external person or group. The Change Requester is then informed of significant elements of the change or asked for approval.

In this model, the function of *Change Manager* is of a purely administrative nature. This person only intervenes to provide guidance and instruction when the Change absolutely needs it: for example, where Service Level Agreements are not adhered to or an unsuitable time window has been chosen. The Change Manager only comes in at a relatively late stage, as most of the organizational tasks are handled by the

Change Coordinator. In S-BPM subjects can be defined as multi-subjects, allowing them to represent the behavior of a team or a group. The Change Manager, modeled as an administrative multi-subject, may represent the functions of the CAB, covering all significant groups and persons such as administrators, technicians, Service Level Managers, operations staff, etc. That is why the CAB is not modeled. Whether a CAB subject is needed is a decision for the individual company.

The Change Coordinator and the Change Implementer play a crucial role in Change Management, as can be seen from the large number of transitions between these two subjects. The *Change Coordinator* is responsible for organizing and coordinating most of the steps needed to produce and implement the Change. They are in contact with almost all subjects, to gather all the necessary technical, administrative and operational information on the Change. In close collaboration with the Change Implementer they draw up the Back-Out Strategy and the Change Strategy, containing all significant details of the Change, such as its criticality, priority, affected components, procedure, etc. The Change Coordinator also handles the scheduling and publishes a Change Release once all the information is to hand. Once the Change Release has been confirmed by the Change Manager, there is no longer anything to stop the Change being executed, and the Order for Change is given directly to the *Change Implementer*. In the event of failure, the Change Implementer immediately informs the Change Coordinator, who in turn communicates this result and awaits a back-out order from the Change Manager in order to have the original situation restored by the Change Implementer.

The *Change Approver* represents the individual functions involved and bears the primary responsibility for checking the Change at the technical level. The Change Approver may be one or more people.

The relationships between the Change Coordinator (CC) and Change Implementer (CI) subjects from the outline reference model are described in more detail below by way of example.

3.3 Examples of Behavior by Selected Actors

The CC receives an RfC from the Change Requester (CR). Once he has checked the format and content of the data in the RfC, he prepares a Change Implementation Strategy as shown in Figure 5. The Change Implementation Strategy defines the technical requirements and the resources and functions required, the criticality, the service impact and the Change type. Apart from detailed descriptions and definite categorizations, the CC and CI then cover different aspects of the Change Strategy, which need to be drawn up and confirmed in a relatively short time in line with the Change objective.

When the CC has completed his part of the Change Implementation Strategy, he sends it to the CI. As can be seen from Figure 6, the CI receives the Change Implementation Strategy prepared by the CC, checks it for completeness and makes any necessary changes. He then accepts or rejects the Change Strategy. In both cases, the information goes back to the CC, who either starts the next task in the process or has

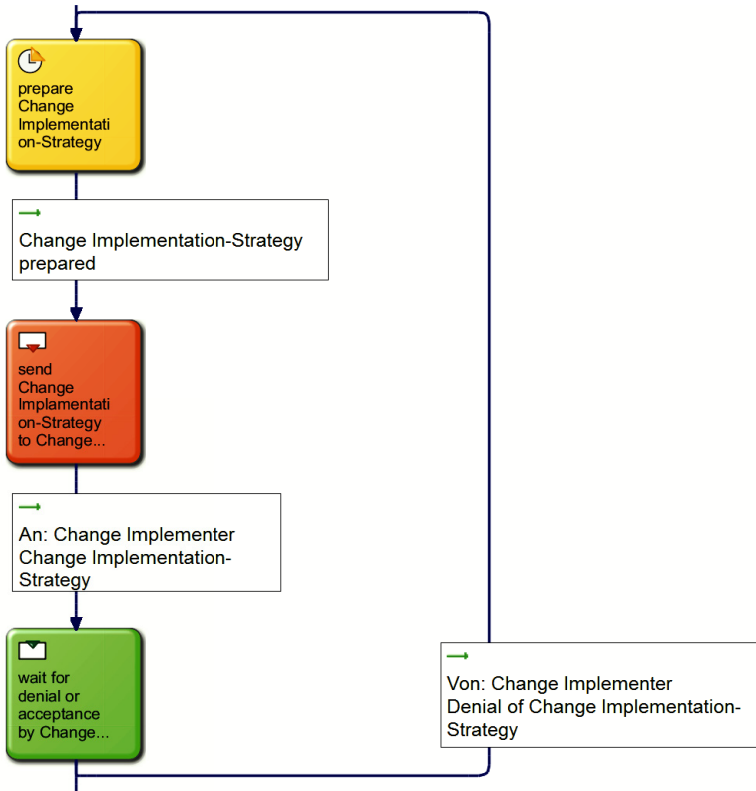


Fig. 5. Change Coordinator receives and prepares the Change Implementation Strategy

to make amendments to the Change Strategy. For this, the S-BPM model includes a loop to jump back to the Function state *prepare Change Implementation Strategy* in the case of rejection. Until the CI accepts the Change Strategy, the CC cannot continue the process.

The subject behavior model for both subjects is determined by these loops. There are always transitions between the CC and the CI, which may be positive or negative in character. Such coordination procedures can demand a great deal of communication in practice and so should be validated and adapted in the operational context.

3.4 Validating the reference model

We will now present a functionality within the S-BPM modeling tool Metasonic Suite, which can be used to execute the reference model for validation purposes. Instantiating a Change Management process allows the activity flow to be tracked, tested and controlled with the aid of a web-based interface (Fig. 7).

On the right of Figure 7 we can see which user is logged in. Beneath the menu bar is a navigation area showing from left to right the processes in which the user is active, and as which subject. At the moment *Patrick Garon* is logged on, and is active in

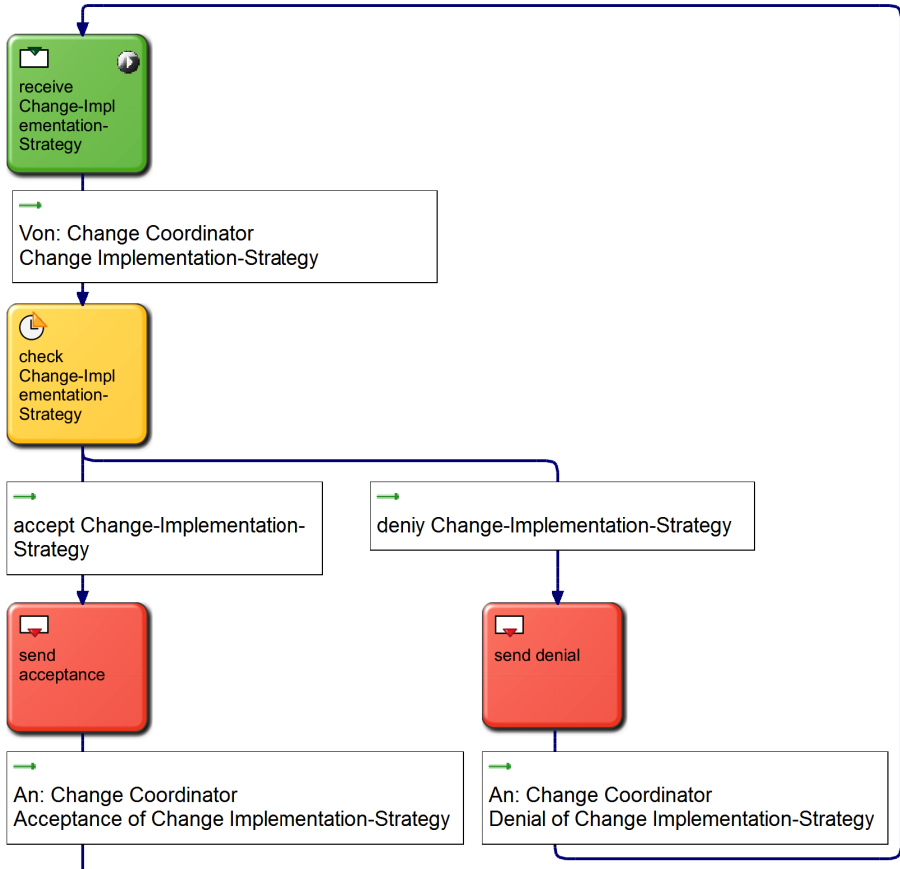


Fig. 6. Input and commitment to the change strategy by the Change Implementer

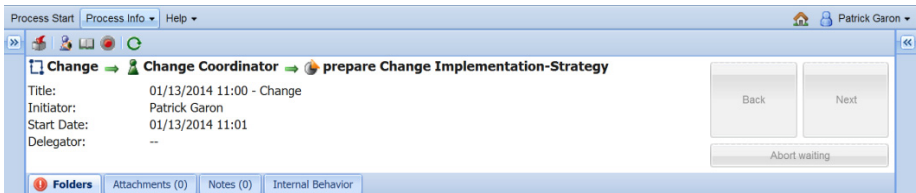


Fig. 7. Change Coordinator: “prepare Change Implementation Strategy”

the *Change Process* as *Change Coordinator* in the function *prepare Change Implementation Strategy*.

Once the CC has delivered his part of the Change Implementation Strategy, he clicks on the Next button to trigger the Send state *send Change Implementation Strategy to CI* and sends this to the Change Implementer. He then passes into the Receive state *wait for denial or acceptance by CI* (see Fig. 8). The process is now

taken forward by the Change Implementer. Fig. 9 shows the Change Implementer that a Change Management process has been instantiated, so a message has arrived.



Fig. 8. Change Coordinator: “wait for denial or acceptance by CI”

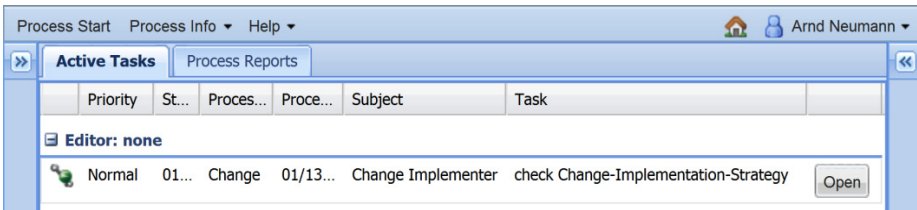


Fig. 9. Change Implementer: “receive Change Implementation Strategy”

After opening the message, the CI switches from the Receive state *receive Change Implementation Strategy* to the Function state *check Change Implementation Strategy* (Figure 10 shows the same basic view as Figure 7).

To continue the process, the *Next* button is pressed once more. A dialog box then opens, asking the CI for a decision. As defined previously in the process model and shown in Figure 11, he can choose between acceptance and rejection. Whichever way the decision goes, a message with the relevant content will pass back to the CC in both cases.

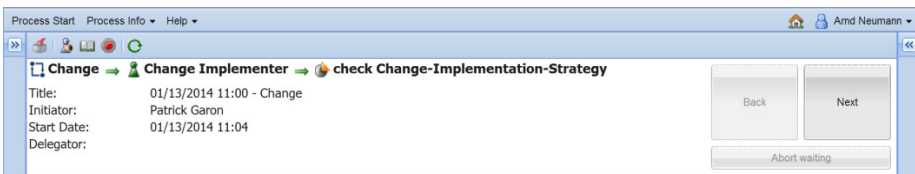


Fig. 10. Change Implementer: “check Change Implementation Strategy”

In this case the CI has accepted the Change Implementation Strategy and triggered the corresponding Send state. The system registers this and, in response to the message sent by the CI, the CC switches from the Receive state *wait for denial or acceptance by CI* to the Function state *prepare Back-Out Strategy*, as this represents the next step in the process. In the case of rejection by the CI, the CC switches from the Receive state *wait for denial or acceptance by CI* back to the Function state *prepare Change Implementation Strategy* and the process step described above starts over, until the Change Implementation Strategy is finally accepted.

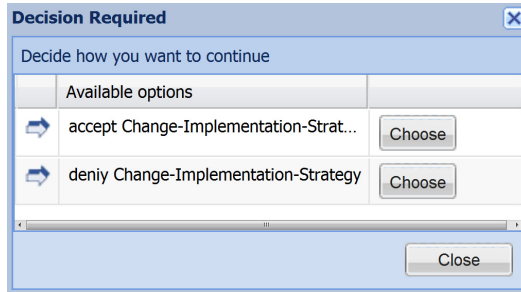


Fig. 11. Change Implementer: decision on the Change Implementation Strategy

3.5 Data Layer Design for Change Management

In order for a Change to be implemented and the Configuration Management Database (CMDB) to be brought up to date on completion of the Change, adequate documentation is required. The ITIL defines the change process for this as a form-based process. The form should include following items (see [15]):

- the objective and justification for the Change,
- the date, the status, the priority, the criticality and the expected effect of the Change,
- the Configuration Items (CIs) affected, any possible downtime, a Back-Out Strategy, and necessary activities before, during and after the change,
- the resources including the necessary technical staff, and a staff deployment plan.

To enable the CMDB to be updated to reflect the actual position, these details must be complete, valid, in line with their definitions, consistent, and as atomic as possible. It must also be possible to keep a history of the individual Changes for future management decisions, which is why high-quality data is essential [10].

In practice, however, the data organization continues to cause substantial quality problems. Gartner suggests that up to 25 percent of the data in the Fortune 1000 companies is incorrect and incomplete, and that 80 percent of the data in these companies is unstructured and decentralized (see [17], p. 317). The documents relating to Change Management likely are no exception.

We will now take an example case to show how the reference model is expanded to include a data layer. The data layer is represented by the business objects which, once they have been configured, are integrated directly into the SBD models with subject-specific views. The views indicate which attributes are relevant and whether they can only be read or also updated. In the example, the Change Coordinator has to fill in the view shown in Figure 12 to prepare the Change Implementation Strategy. Along with text fields, business objects can also be defined as lists, “forcing” the user into a defined selection from a case register. For the Change type, for example, the CC can only choose between major, significant and minor. Once the CC has saved his input, he can send it to the CI.

Change → **Change Coordinator** → **prepare Change Implementation-Strategy**

Title: 10/15/2013 09:25 - Change
 Initiator: Patrick Garon
 Start Date: 10/15/2013 09:25
 Delegator: --

Back Next

Abort waiting

***Folders** Attachments (0) Notes (0) Internal Behavior

Technical Requirement Description
 Technical Requirement 1
 Technical Requirement 2

Criticality

Description
 Description

Category
 medium

Customer Service Impact

Impact Description
 Impact Description 1
 Impact Description 2

Impact Category
 medium

Consequence of Refrain
 Consequence 1
 Consequence 2

Change Type
 significant

Close Draft Save

Fig. 12. Data view for the Change Coordinator to prepare the Change Implementation Strategy

Process Start Process Info Help

Amr Neumann

Change → **Change Implementer** → **check Change-Implementation-Strategy**

Title: 10/15/2013 09:25 - Change
 Initiator: Patrick Garon
 Start Date: 10/15/2013 09:33
 Delegator:

Back Next

Abort waiting

Folders Attachments (0) Notes (0) Internal Behavior

Technical Requirement Description
 Technical Requirement 1
 Technical Requirement 2

Criticality

Description
 Description

Category
 medium

Customer Service Impact

Impact Description
 Impact Description 1
 Impact Description 2

Impact Category
 medium

Consequence of Refrain
 Consequence 1
 Consequence 2

Change Type
 significant

Feedback_CI

Close Draft Save

Fig. 13. Data view for the CI to display the Change Implementation Strategy prepared by the CC

After opening the message, the CI sees the view depicted in Figure 13. He cannot change the data provided as in our case since this is not covered by his access rights, which is why the details entered by the CC are grayed out. He can however give feedback on the Change Implementation Strategy and reject or confirm this in the next step. If he confirms the Change, feedback is not mandatory, but in the case of rejection it is essential. After the CI has entered his feedback, he saves his input and sends it back to the CC, who then makes appropriate changes and returns the data to the CI.

As the example shows, a subject-oriented approach to Change Management can provide end-to-end documentation of the Change using a managed data store containing a set of relevant business objects. The business objects hold all process-related data, such that a coherent basis for operational decision making is established.

4 Conclusion

The ITIL is a de-facto standard and should be implemented in practice in a process-oriented way. In the basic form of the ITIL, however, there are evident gaps as – to the best of our knowledge – no complete and adequately detailed process descriptions are available as reference models. The subject-oriented reference model for the Change Management process presented here provides a design template which can be reused as an application model with the aid of the S-BPM mechanisms and tools. Institutions can select and adapt components of the model. Because the S-BPM models are executable (model-to-execute), the results of the modification can be validated directly, providing a high degree of agility in process definition and rollout.

The proposed model can be used by managers, analysts and consultants in the domain of IT service management for different purposes:

1. The model artifacts could be used as blueprint in order to (re-)organize the domain of Change Management in IT service centers. In particular, the designed models provide relevant actors and corresponding behavioral patterns [23] in order to design a modern, process-oriented organization.
2. The reference model could serve as a guideline to evaluate and enhance software solutions to support the Change Management process with regard to the application and data layer. In practice, application support for ITIL processes is predominantly realized by use of office tools like spreadsheet calculation software which induces severe data quality problems [3]. These problems can be tackled by using the presented reference model with the associated data layer and its business objects. As a consequence, the degree of maturity of the IT service organization is expected to increase.
3. In addition, the model can also be used as teaching tool in industry and university. Since the model is executable, the complex procedures of communication and coordination in the domain of Change Management can be demonstrated close to reality. Beyond that, process trainings [2] based on S-BPM can enable students to walk through ITIL-based processes by use of a computer supported, cooperative web based interface, such that learning effectivity could be positively stimulated.

Future research has to concentrate on the practical evaluation [8] and refinement of the presented model, for example by carrying out case studies and applicability evaluations in IT service organizations.

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